RESPONSE UNDER 37 CFR 1.116

EXPEDITED PROCEDURE

EXAMINING GROUP NUMBER 1731

Amendment Under Rule 116

Amendment Under Rule 116 requests that the case be amended as follows to place it in condition for allowance.

The claims don't contain any new limitations or radical changes that would raise new issues.

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

CLAIMS

What I claim as my invention is:

1 – 5. (Canceled)

6. (Withdrawn) The product made by the process for producing said optical fiber in claim 1.

7 –10. (Canceled)

11. (Withdrawn) The robust diameter-controlled optical fiber made by the process in claim 7.

12–15. (Canceled)

16. (Withdrawn) The product made by the process in claim 12.

17–19. (Canceled)

20. (Withdrawn) The product made by said control method in claim17.

21. (currently amended) A drawing process for producing an optical fiber comprising the steps of:

measuring either the outer diameter or ~~geometrical~~ shape ~~parameter~~ of a preform;

feeding said preform into a furnace to heat and melt said preform;

heating and melting said preform for said optical fiber;

while heating and melting, drawing said optical fiber from said preform under tension to form said optical fiber; ~~and~~

measuring the outer diameter of said optical fiber at a position below the furnace;

providing a control system with the measured outer diameter or ~~geometrical~~ shape ~~parameter~~ of said preform , the measured outer diameter of said optical fiber, a predetermined nominal preform value and a predetermined nominal fiber value to control said drawing process, [[;]]

wherein the control process controls at least one member of the group comprising:

a feeding speed control of said preform, a drawing speed control of said optical fiber, and a tension control of said optical fiber;

whereby said optical fiber drawing process will be robustly controlled with robust performance of said process and robust quality of said optical fiber [[,]] against deviations of the preform outer diameter and shape at different locations and against deviations of various ~~performs~~ preforms, making a robust diameter-controlled optical fiber.

22. (currently amended) The drawing process as claimed in claim 21, wherein the measurement of said preform outer diameter or ~~geometrical~~ shape ~~parameter~~ is on-line as

a preferred method;

the measured diameter or shape ~~geometrical parameter~~ is on-line real-time fed to said control system; and

said control system generates a control signal based on the measured ~~perform~~ preform diameter or shape ~~geometrical parameter~~, its deviation from ~~a~~ the predetermined nominal preform value, and said nominal preform value,

for controlling said process in face of the deviations of the preform diameters or ~~geometrical~~ shape ~~parameters~~.

23. (canceled)

24. (currently amended) The process as claimed in claim 21, further including the steps of:

~~measuring the outer diameter of said optical fiber at a position below the furnace, wherein the size of said preform is changing substantially to form said optical fiber by the drawing;~~

~~providing said control system with the measured outer diameter of said optical fiber, a predetermined nominal preform value and a predetermined nominal fiber value; and~~

generating control signals based on ~~two different measurement data sets: one from~~ the preform measurement and ~~another from~~ the fiber measurement, their respective deviations from their respective predetermined nominal values, and ~~said~~ their respective nominal values, for said optical fiber drawing process control;

whereby further to maintain the robust performance of said drawing process and to

provide the robust quality of said optical fiber in presence of the deviations of said outer diameter and shape of said preform.

25. (currently amended) The process as claimed in claim 21, ~~further including the steps of:~~

~~measuring the outer diameter of said optical fiber as it is being drawn~~ wherein the position of measuring the optical fiber is at a position at which shrinkage of the outer diameter of said optical fiber is not larger than a predetermined allowable diameter deviation value of said optical fiber;

~~providing said control system with the measured outer diameter of said optical fiber;~~

said control system generates ~~generating~~ control signals to control ~~a~~ the drawing speed of said fiber from the melting preform and ~~a~~ the feeding speed of said preform into the furnace, based on the measured ~~perform~~ preform outer diameter or ~~geometrical~~ shape ~~parameter~~, its deviation from ~~a preselected~~ the predetermined nominal preform ~~diameter or parameter~~ value, said nominal preform ~~diameter or parameter~~ value, the measured optical fiber outer diameter, its deviation from ~~a preselected~~ the predetermined nominal fiber ~~outer diameter~~ value, and said nominal fiber ~~diameter~~ value; and

the drawing process being carried out at said drawing speed and said feeding speed .

26. (currently amended) A drawing process for producing an optical fiber comprising the steps of:

heating and melting a preform in a furnace for the optical fiber;

while heating and melting, drawing said optical fiber from said preform under tension to

form said optical fiber;

measuring the outer diameters of said optical fiber, which is bare before coating, at two or more different locations by respective measurement devices before the coating~~;~~,

wherein a first position is close to the furnace, and

a second position is below the first position, at this second position shrinkage of the outer diameter of said optical fiber, while stretched under the drawing, is not larger than a predetermined allowable bare fiber diameter deviation value of said optical fiber, or immediately before the coating;

coating said optical fiber;

producing different measurement data sets of the bare fiber respectively from the different locations; and

providing a control system with the different measurement data sets , ~~based on that said drawing process is being controlled;~~

wherein said control system

has a first preselected nominal value for the first measurement data set and a second different preselected nominal value that is less than the first preselected value for the second measurement data set,

calculates the deviations of the two bare fiber measurement data sets from their respective preselected values, and

dynamically controls a fiber drawing speed and a preform feeding speed for the drawing

process based on the deviations of the two bare fiber measurement data sets from their respective preselected values;

whereby to maintain robustly controlled performance of said optical fiber drawing process and robust quality of said optical fiber by monitoring the changes of the bare fiber diameters.

27. (canceled)

28. (currently amended) The process as claimed in claim 26, further including a measurement of the outer diameter of said preform above the heating and melting;

providing said control system with the measured outer diameter of said preform;

~~dynamically controlling a~~ wherein the control of the preform feeding speed and ~~a~~ the fiber drawing speed of said drawing process is further based on the measured ~~perform~~ preform outer diameter, its deviation from a preselected nominal preform diameter, and said nominal preform diameter, in addition to the different measurement data sets of the bare fiber.

29. (canceled)

30. (previously presented) A control method for an optical fiber drawing process control including the steps of:

measuring a preform outer diameter by a measurement device located before a heating and melting stage, in which the preform is fed and is changing its geometrical size substantially to form said optical fiber by drawing;

measuring said optical fiber by an outer diameter measurement device located after said heating and melting stage;

providing the measurement data into a control system which controls a feeding speed of said preform into the heating and melting stage and a drawing speed of said fiber;

calculating a preform diameter deviation of the measured preform diameter from a preselected nominal preform diameter value, and a fiber diameter deviation of the measured fiber diameter from a preselected nominal fiber diameter value;

generating control signals based on the preform deviation and the fiber deviation for said optical fiber drawing process control; and

adjusting the feeding speed of said preform and the drawing speed of said fiber as said control signals command;

whereby to get robust performance of the process against diameter fluctuations and shape changes of the said preform, and to get robust diameter-controlled optical fiber.

31. (previously presented) The control method in claim 30, wherein

said control signals are further based on the measured preform diameter and the preselected nominal diameter in addition to the preform diameter deviation.

32. (previously presented) The control method in claim30, wherein

said optical fiber measurement device as a first bare fiber outer diameter measurement device is located near a furnace for said heating and melting stage, and the measured

optical fiber is bare ;

said control method further includes:

locating a second bare fiber outer diameter measurement device after the first bare fiber measurement device and before a coating device in which the fiber is coated;

providing said control system with a second (final) bare fiber diameter measurement from the second bare fiber measurement device;

calculating a second bare fiber diameter deviation of the measured second bare fiber diameter from a preselected second nominal fiber diameter value which is less than the first nominal fiber diameter value; and wherein

said control signals are further based on this second bare fiber diameter deviation, thus said control signals are based on the deviation of the measured second (final) diameter of the bare fiber coming into the coating device from the preselected second nominal fiber diameter value, the deviation of the measured first diameter of the bare fiber leaving out the furnace from the preselected first nominal fiber diameter value, and the deviation of the measured outer diameter of the preform coming into the furnace from the preselected nominal preform diameter value.

33. (currently amended) The control method in claim 32, wherein

said control signals are further based on the measured preform diameter and the preselected nominal diameter in addition to the preform diameter deviation; and

~~thus, said control signals are based on the measured preform diameter, the deviation~~

~~of the measured preform diameter, the nominal preform diameter, the first bare fiber diameter deviation, and the second bare fiber diameter deviation;~~

the control signals are further calculated by an algorithm for said adjusting the feeding speed by an adjustment Δv_f to satisfy

$$\Delta v_d = [v_f \cdot (2D \cdot \Delta D + \Delta D^2) + \Delta v_f \cdot (D + \Delta D)^2] / d^2$$

where ΔD is the preform diameter deviation, $D+\Delta D$ is the measured preform diameter, D is the nominal perform diameter, v_f is a predetermined perform feeding speed, Δv_d is an adjustment of the drawing speed, and d is the nominal fiber diameter;

whereby to robustly control performance of said drawing process and quality of said optical fiber diameter against the deviation of the preform, various disturbances and perturbations affecting on the bare fiber diameter in the fiber drawing process.

34 (currently amended) The control method as claimed in Claim 33, wherein the control signals are further based on ~~fluctuation data from the current measurements and~~ historical measurement ~~history~~ data of the preform and the bare fiber being drawn over a period;

whereby the process control provides robust performance of the drawing process and robust quality of the fiber further against the fluctuations of the diameters, time-lag and time-lead of said measurements corresponding to the heating and melting stage, and environment fluctuations of the heating and melting.